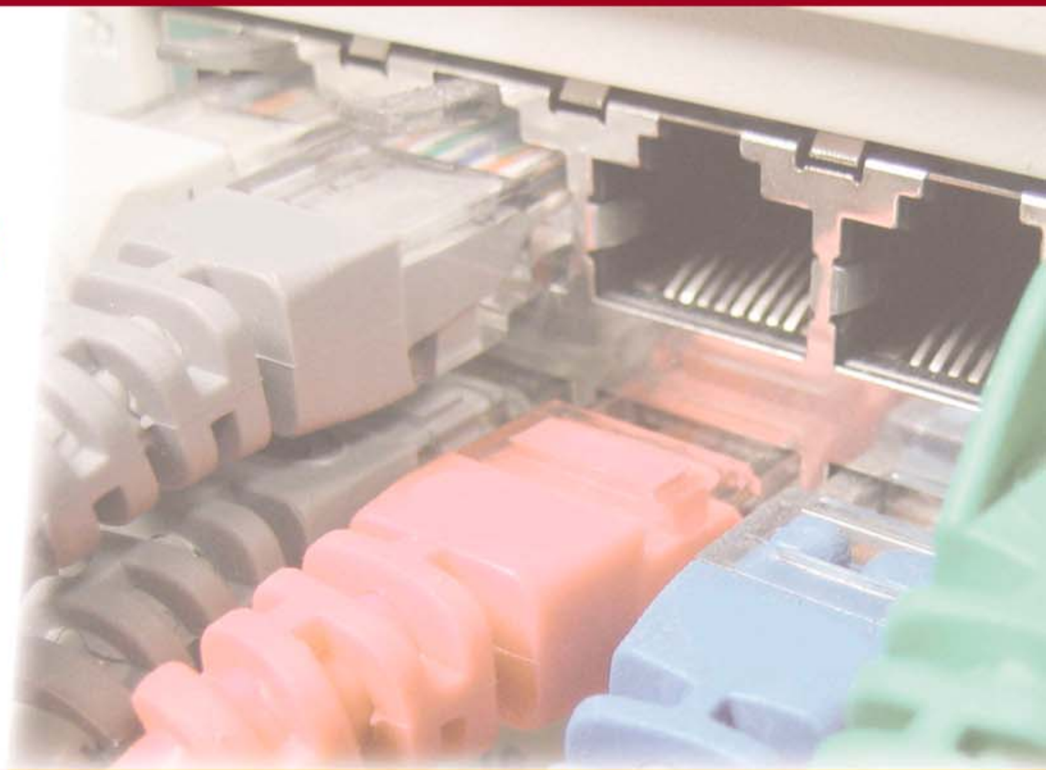
LAN eXtensions for Instrumentation



LXI Trigger Bus Cable & Terminator Specification 1.1

August 28, 2006

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LXI Trigger Bus
Cable And Terminator Specifications

Revision 1.1

August 28, 2006 Edition

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This preliminary specification establishes a starting point for the LXI specification. The LXI Consortium Board of Directors will commission a technical committee to move this specification forward, and it is expected the rules and recommendations described in this initial draft will remain unless they are found to be incorrect or incomplete. Several sections highlight “Roadmap” items. These items were considered but not completed due to insufficient time or expertise. Some, like software triggering, must be completed prior to releasing compliant products. Others may not be required to release LXI products. This specification is the property of the LXI Consortium, a Delaware 501c3 corporation, for the use of its members.

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Revision history:

Revision	***Description***
1.1 August 28, 2006	First release.

1 Overview

The LXI Trigger Bus is implemented using a cabling system to interconnect multiple LXI instruments. Each LXI Device that supports the LXI Trigger Bus has two Trigger Bus connectors that provide a pass-through connection of the bus. The interconnecting cables form the backbone of the Trigger Bus, with the signals routing through each participating instrument. At each end of an LXI Trigger Bus connection segment a termination device is required, which is provided by the LXI Trigger Bus Terminator. The LXI Trigger Bus Terminator is attached to the second connector at each segment end or to the end of the last cable.

The requirements in this Standard define the construction and testing of the raw interconnecting cable material, the construction of finished LXI Trigger Bus cables, and the construction and testing of the LXI Trigger Bus termination blocks. Compliance with the requirements set forth in this Standard assures generic cabling performance and interoperability when products from different manufacturers are mated.

1.1 Intended Audience

This LXI Standard is intended for use by designers and manufacturers of devices intended to support the LXI Trigger Bus.

1.2 Purpose And Scope

This document specifies the requirements for the cable used to construct LXI Trigger Bus Cable assemblies. It defines the mechanical construction, and the electrical characteristics of the cable. The Standard also provides construction details for the completed LXI Trigger Bus cables and LXI Trigger Bus termination blocks.

1.3 Definition of Terms

Throughout this document you will see the following headings on paragraphs. These headings identify the contents of the paragraph:

RULE: Rules **SHALL** be followed to ensure compatibility for LAN-based devices. A rule is characterized by the use of the words **SHALL** and **SHALL NOT**. These words are not used for any other purpose other than stating rules.

RECOMMENDATION: Recommendations consist of advice to implementers that will affect the usability of the final device. Discussions of particular hardware to enhance throughput would fall under a recommendation. These should be followed to avoid problems and to obtain optimum performance.

PERMISSION: Permissions are included to clarify the areas of the specification that are not specifically prohibited. Permissions reassure the reader that a certain approach is acceptable and will cause no problems. The word **MAY** is reserved for indicating permissions.

OBSERVATION: Observations spell out implications of rules and bring attention to things that might otherwise be overlooked. They also give the rationale behind certain rules, so that the reader understands why the rule must be followed. Any text that appears without heading should be considered as description of the specification.

2 CABLE REQUIREMENTS

2.1 Cable Mechanical Requirements

The LXI Trigger Bus cable is a round cable consisting of eight twisted pairs. Each twisted pair is individually shielded with an aluminum/mylar wrap and a 28 gage tin/copper stranded drain wire. The eight twisted pair sub assemblies are combined with a poly filler, wrapped with a 38 gage tin/copper spiral serve outer shield which is covered with a mylar separator. The cable is then covered with a PVC outer jacket.

2.1.1 Rule – Outer Jacket Material and Thickness

The outer jacket shall be a nominal 30 mil thick pressured PVC construction rated for 80ºC and 30 V. The outer jacket has a minimum thickness of 24 mil per AWM style 2502. The finished cable must be UL listed and CSA recognized.

2.1.1.1 Observation – Outer Jacket Color

The outer jacket color is not specified which allows each manufacture to construct cable assemblies which conform to its own corporate color schemes and standards.

2.1.2 Rule – Twisted Pair Wire Diameter And Insulation

Each twisted pair of wires shall consist of two 26 gage silver plated copper stranded wires. Each wire shall be insulated with 14 mil nominal, 12 mil minimum cellular polyethylene rated for 80ºC 30 V. The nominal outer diameter of the insulation is 0.048” ± 0.002”

2.1.2.1 Observation

A minimum of 26 gage copper wire with a surface conductivity equal to or better than silver is required to achieve the necessary system bandwidth.

2.1.3 Rule – Twisted Pair Wire Color Coding

The wires used to construct the 8 twisted pairs shall be color coded such that each wire is uniquely identifiable.

2.1.3.1 Recommendation – Twisted Pair Wire Color Coding

It is recommended that the twisted pairs of the LXI Trigger Bus cable be color coded per Table 2.1.

2.1.3.2 Observation – Twisted Pair Wire Color Coding

Since color coding does not affect electrical connectivity or performance of the wires, any other suitable color coding scheme may be used so long as each twisted pair and connection can be uniquely identified.

Pair Number	P Color / Stripe	N Color / Stripe
1	White / Blue	Blue / White
2	White / Orange	Orange / White
3	White / Green	Green / White
4	White / Brown	Brown / White
5	White / Gray	Gray / White
6	Red / Blue	Blue / Red
7	Red / Orange	Orange / Red
8	Red / Green	Green / Red

Table 2.1

2.1.4 Rule – Twisted Pair Shielding

Each twisted pair of wires shall be individually shielded with an aluminum/mylar foil. The foil shall be wound with the conductive surface towards the inside along with a 28 gage tin plated copper drain wire for connectivity to the shield.

2.1.5 Rule – Mechanical Construction of Twisted Pairs

Each of the twisted pairs used to construct the Wired Trigger Bus cable shall be built per Figure 2.1. The materials used shall be as identified in Table 2.2

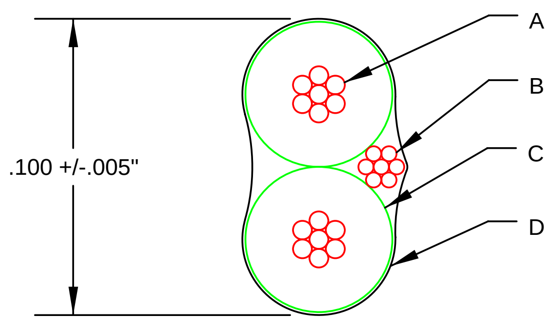

Figure 2.1

2.1.6 Rule – Mechanical Construction Of The Completed Cable

Eight twisted pair subassemblies shall be combined with a center core, wrapped with an outer shield and jacketed per Figure 2.2. The materials used shall be as identified in Table 2.2.

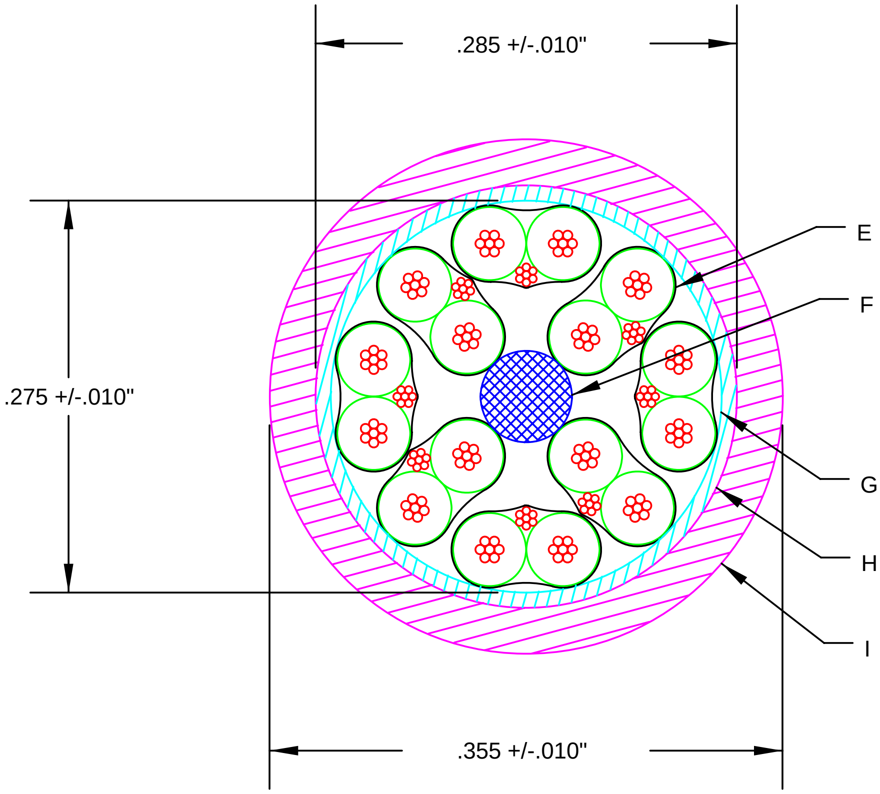

Figure 2.2

2.1.7 Rule – Materials Used

The cable shall be constructed using the material types listed in Table 2.2.

Item	Type	Material
A	Signal Wire Conductor	26 AWG Silver Plated Copper, Stranded 7 x 0.0063”, Concentric OD 0.019” ± 0.001”
B	Drain Wire	28 AWG Tin Plated Copper, Stranded 7 x 0.005”
C	Signal Wire Insulation	14 mil cellular polyethylene 80C 30V, 12 mil min. cellular polyethylene insulation Nominal O.D. 0.048” ± 0.002” AWM style 1589
D	Twisted Pair Shield	Aluminum/Mylar shield. Wound foil side in.
E	Twisted Pair Subassembly	See Figure 2.1 For Construction
F	Core Filler	Polyethylene Filler.
G	Separator	Opaque Mylar.
H	Outer Shield	38 AWG Tin/Copper spiral serve to 85% coverage.
I	Outer Jacket	30 mil pressured PVC jacket 80°C 30 V. 24 mil minimum PVC jacket AWM style 2502.

Table 2.2

2.1.7.1 Permission – Use Of Alternate Materials

Other materials may be used so long as the cable meets all the specified electrical, mechanical, and safety requirements specified in this document.

2.1.7.2 Observation – Use of Alternate Materials

The materials used in the construction of the cable directly affect the electrical performance, mechanical performance, and safety approvals.

2.2 Electrical Characteristics

A cable constructed to the standard has the characteristics described in Table 2.3

Nom. Diff. Characteristic Impedance	100 ohms (+10 ohms, -15 ohms)
Nom. Inductance @ 10 kHz	0.47 uH/meter
Nom. Capacitance – Conductor To Conductor @ 10 kHz	41.0 pF/meter
Nom. Capacitance – Conductor To Other Conductor & Shield @ 10 kHz	65.6 pF/meter
Nom. Velocity of Propagation	74%
Nom. Conductor DC Resistance @ 20C	14.57 ohms / 100 meters
Nom. Outer Shield DC Resistance @ 20C	1.7 ohms / 100 meters
Max. Operating Voltage – UL	30 V RMS

Table 2.3

2.2.1 Rule – Electrical Characteristics

If a cable is constructed using alternate materials from those identified in Table 2.2, then the resulting cable shall conform to the specifications listed in Table 2.3.

2.3 Cable Electrical Conformance Testing

The following section describes the tests a cable manufacturer should use to demonstrate compliance of a sample cable to the LXI Wired Trigger Bus Cable Specification. A supplier of LXI Wired Trigger Bus Cable Assemblies should ensure that the cable used in constructing a Cable Assembly has been sample tested.

2.3.1 Characteristic Impedance

The characteristic impedance of each twisted shielded pair should be measured using a Differential TDR (Time Domain Reflectometer) such as an Agilent model 54754A plug-in installed in an appropriate mainframe (Agilent 86100B or equivalent), or other equivalent TDR.

2.3.1.1 Characteristic Impedance Test Method

A 100cm sample of the cable is prepared for test by removing 3.5cm of the outer insulation material, gathering up the outer shield wires and twisting them together at one end only. A twisted pair is exposed by removing 6mm of the shielding foil, thereby exposing two insulated wires and a bare drain wire. The insulated wires are stripped back 2mm to expose the conductors.

Two coaxial cable assemblies are prepared using 15cm of 50 ohm 0.085" formable coaxial cable with SMA type connectors on one end. The other end of each cable assembly has the braid and dielectric stripped back 2mm. The stripped end of the two coaxial cables are laid side by side and the outer braids are soldered together over a length of approximately 6cm from the stripped ends. The test cable is then attached to the coaxial cables, with the drain wire attached to the coaxial cables' braids, and with each of the twisted pair wires connected to one of the two center conductors. See Figures 2.3 and 2.4 for details.

The two SMA connectors are attached to the TDR's test ports, and the TDR is adjusted to display the reflected waveform from the initial edge to the end of the cable (where the impedance goes toward infinity). The TDR should then be adjusted to measure the differential impedance at approximately 6cm into the test cable to avoid erroneous readings due to the transition areas where the test cable assembly attaches to the cable under test. Record the measured impedance and confirm that it conforms to the requirements stated in Table 2.3.

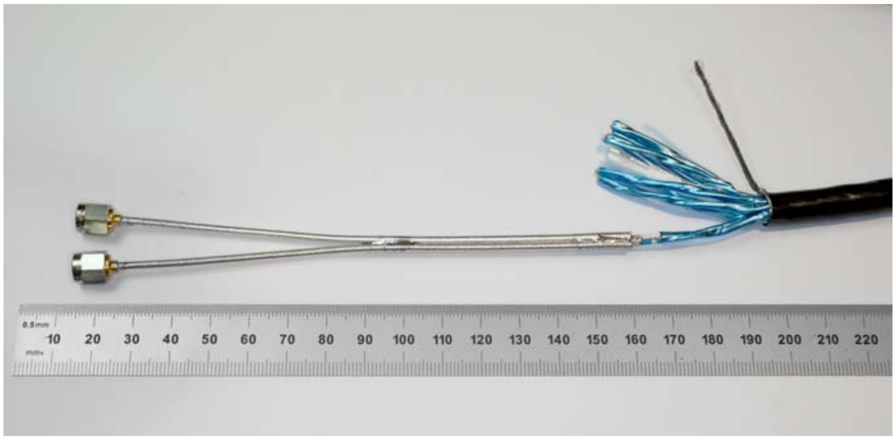

Figure 2.3

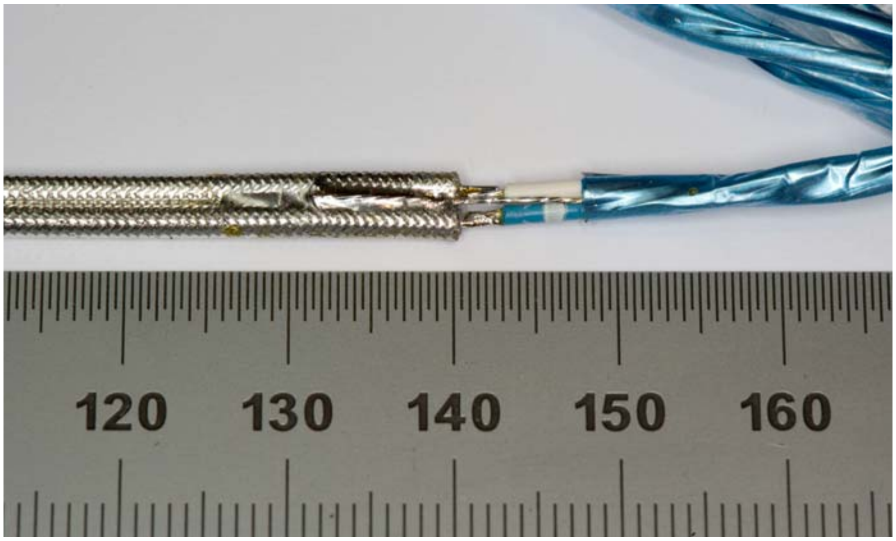

Figure 2.4

2.3.2 Inductance

The inductance of the signal conductors is verified using an LCR bridge (such as the Agilent 4263B or equivalent).

2.3.2.1 Inductance Test Method

A 1.025 meter sample of cable is prepared for testing by striping back 5mm of outer jacket and cutting away the outer shield wires. A signal pair is selected, the wires are exposed by removing their inner shield foil, and are stripped back 3mm. The two signal wires along with the shield drain wire are joined together and soldered.

At the other end of the cable, 25mm of outer jacket is stripped away and the outer shield wires are cut away. Separate the eight twisted pairs and select the same pair as previously selected. Remove 25mm of its inner shield, and strip back the two signal wires 5mm. One of the two signal connections is connected to the shield drain wire.

The LCR bridge is set to measure inductance at a test frequency of 10KHz and the cable sample is connected. Connect the wire with the drain wire to the high side of the LCR bridge, and the other wire to the low side (connecting the drain wire to the high side reduces noise pickup). Record the inductance measured.

2.3.3 Capacitance

The capacitance of the signal connections is verified using an LCR bridge (such as the Agilent 4263B or equivalent).

2.3.3.1 Capacitance Test Method

A 1.025 meter sample of cable is prepared for testing by striping back 25mm of outer jacket and cutting away the outer shield wires. Separate the eight twisted pairs and select the same pair as previously selected. Remove 25mm of its inner shield, and strip back the two signal wires 5mm.

The LCR bridge is set to measure capacitance at a test frequency of 10KHz and the cable sample is connected. Connect one of the signal wires to the high side of the LCR bridge, and the other signal wire to the low side. Record the conductor to conductor capacitance measured.

Remove the signal wire connected to the high side of the LCR bridge and connect the shield drain wire in its place (connecting the drain wire to the high side reduces noise pickup). Record the conductor to shield capacitance.

2.3.4 Velocity Of Propagation

The velocity of propagation is measured using the same equipment and setup used to measure characteristic impedance (section 2.3.1).

2.3.4.1 Velocity of Propagation Test Method

The test cable assembly used in section 2.3.1.1 is connected to the differential TDR for measurement. The TDR is adjusted so that the small bump in impedance where the fixture cables attach to the test cable is visible as well as the end of the cable where the impedance goes toward infinity. Using the cursors on the TDR, measure the time from the center of the impedance bump to the point where the impedance goes toward infinity. This is the time delay through 1 meter of test cable. Note that the test cable must be accurately measured and cut to within 5mm of 1 meter.

The velocity of propagation is calculated by dividing the velocity of light by one half the measured delay (the measured delay is a round trip time up and down the test cable) times 100 percent.

Velocity of Propagation = $100\% \bullet \left(\frac{3.336 \, {}^{nS}/_{M}}{{}^{1}/_{2} \Delta T \, {}^{nS}/_{M}} \right)$

Record the measured velocity of propagation and confirm that it conforms to the requirements stated in Table 2.3.

2.3.5 DC Resistance

The DC resistance measurement is made using a four-wire method. A digital multimeter which can resolve a minimum of 10 milliohms is required. A DMM such as the Keithley model 2000 or equivalent should be used.

2.3.5.1 DC Resistance Test Method

A 20 meter sample of the cable is prepared for test by removing 2.5cm of the outer insulation material, gathering up the outer shield wires and twisting them together at both ends. A single insulated wire is isolated from a twisted pair at both ends, and its insulation is stripped back 3mm on each end. Wire the DMM to two ends of the sample cable using the four-wire measurement technique (refer to the DMM's user manual for details). Record the measured resistance and confirm that it conforms to the requirements stated in Table 2.3 for the conductor DC resistance.

Wire the DMM to the two ends of the outer shield wires (that were gathered up in the previous step) of the same 20 meter sample. Measure the resistance of the shield wires using the four-wire measurement technique. Record the measured resistance and confirm that it conforms to the requirements stated in Table 2.3 for the outer shield DC resistance.

3 FINISHED LXI TRIGGER BUS CABLE ASSEMBLIES

3.1 Finished LXI Trigger Bus Cable Assembly Requirements

The LXI Trigger Bus cable assemblies consist of a length of LXI Trigger Bus compliant cable wired to industry standard Micro-D connectors at each end.

3.1.1 Rule – LXI Trigger Bus Cable Connectivity

The LXI Trigger Bus cable assemblies shall be wired per Table 3.1. Cable assemblies shall specifically not connect to the +3.3 volt pin, the +3.3 volt return pin, or the Reserved pins.

3.1.2 Rule – Connector Shielding

Each Micro-D connector shall provide a shielded back shell to protect against radiated emissions and provide a mechanical strain relief.

3.1.2.1 Observation – Connector Construction

The back shell may be designed as a metal casting which provides strain relief, EMI management, and an exterior finish. The connector may alternately be designed as a formed sheet metal component with a plastic boot or plastic over-mold cover to provide the finished component.

3.1.3 Rule – LXI Trigger Bus Cable Labeling

An LXI Trigger Bus cable shall be labeled with the LXI logo, the revision of this specification to which it complies, and its length in meters, an example of which is shown in Figure 3.1.

CONN	SIGNAL NAME	P1 PIN	WIRE COLOR	P2 PIN	NOTES
1	+3.3V	1	N/C	1	
2	+3.3V RETURN	2	N/C	2	
3	LXI1p	3		3	Paired with pin 4
4	LXI1n	4		4	Paired with pin 3
5	GND	5		5	Drains from conn 3-4 & 6-7
6	LXI3p	6		6	Paired with pin 7
7	LXI3n	7		7	Paired with pin 6
8	GND	8		8	Drains from conn 9-10 & 12-13
9	LXI5p	9		9	Paired with pin 10
10	LXI5n	10		10	Paired with pin 9
11	RESERVED	11	N/C	11	
12	LXI7p	12		12	Paired with pin 13
13	LXI7n	13		13	Paired with pin 12
14	LXI0p	14		14	Paired with pin 15
15	LXI0n	15		15	Paired with pin 14
16	RESERVED	16	N/C	16	
17	LXI2p	17		17	Paired with pin 18
18	LXI2n	18		18	Paired with pin 17
19	GND	19		19	Drains from conn 14-15 & 17-18
20	LXI4p	20		20	Paired with pin 21
21	LXI4n	21		21	Paired with pin 20
22	GND	22		22	Drains from conn 20-21 & 23-24
23	LXI6p	23		23	Paired with pin 24
24	LXI6n	24		24	Paired with pin 23
25	RESERVED	25	N/C	25	
26	CHASSIS	26		26	Outer shield wires – attach to the connector shell.

Table 3.1

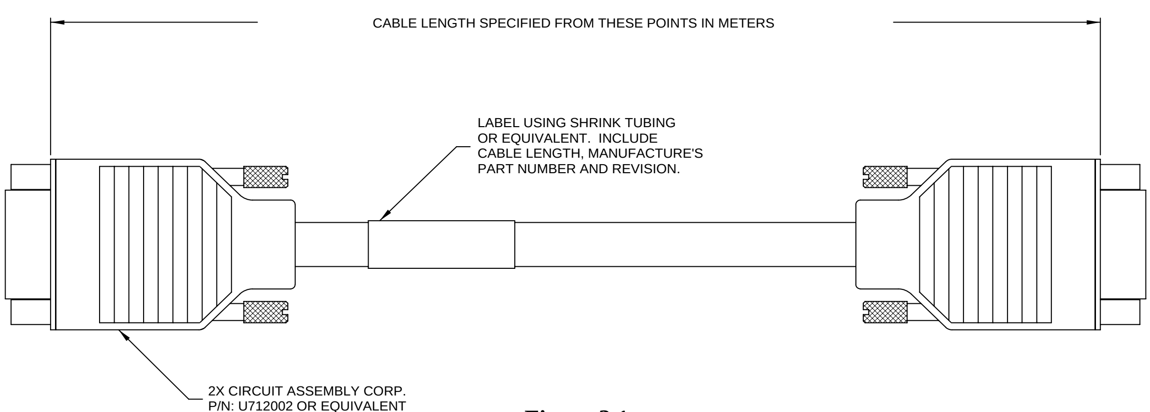

Figure 3.1

3.2 LXI Trigger Bus Cable Assembly Test Requirements

3.2.1 Rule – LXI Trigger Bus Cable Assembly Test Requirements

The completed LXI Trigger Bus Cable assembly shall be tested for proper continuity and short circuits. This may be accomplished using standard cable test equipment and fixtures.

3.2.2 Rule – LXI Trigger Bus Cable Assembly Wire Pairing

The completed LXI Trigger Bus Cable assembly shall be compliance tested for proper pairing of the differential signals.

3.2.2.1 Permission – Cable Assembly Wire Pairing

The testing of wire pairing is required for compliance testing to assure that the assembly methods are correct. Ideally wire pair testing would also be performed as part of a production test but, may prove to be significantly cumbersome to implement in a production environment. Once proper assembly methods are established, as demonstrated by the compliance test, no production test for wire pairing is required.

3.2.2.2 Observation – Cable Assembly Wire Pairing

While continuity testing assures that all signals are connected and not cross-wired, it does not assure that each differential signal is correctly paired in the cable assembly.

3.2.3 Wire Pairing Test Method

An LXI Trigger Bus cable is tested for proper signal pairing by testing for the presence of cross-talk to alternate channels. Since each pair is individually shielded, a properly constructed cable assembly should show very low levels of cross-talk to alternate channels. A cable assembly, which has one or more connections mis-paired, will display a notable amount of cross-talk to an alternate channel, revealing the mis-wired connection.

3.2.3.1 Wired Pairing Test Setup

The wired pairing test setup consists of a pulse generator (Tektronix AFG3252 or equivalent), an LXI Trigger Bus Adapter (Pickering Interfaces P/N 60-982-002 or equivalent), an LXI Trigger Bus Probe (Pickering Interfaces P/N 60-981-001 or equivalent), an LXI Trigger Bus Terminator (Circuit Assembly Corporation P/N U712003 or equivalent), An Oscilloscope with a minimum 1GHz bandwidth (Tektronix DPO4104 or equivalent), and the LXI Trigger Bus cable assembly under test.

Figure 3.2 shows the basic test setup. The pulse generator is wired to the LXI Trigger Bus Adapter such that it can drive any one of the eight LXI Trigger channels. The LXI Trigger Bus Adapter directly drives the Cable Under Test and provides the terminations required at that end of the cable. The other end of the Cable Under Test is connected to the LXI Trigger Bus Probe. The LXI Trigger Bus Probe has a through type connection, so it requires an external terminator. The oscilloscope monitors the outputs of the Probe and two channels are required. One channel monitors the driven channel and provides a trigger source for the Oscilloscope, and the other channel is used to check for cross-talk to the other LXI Trigger Bus signal pairs.

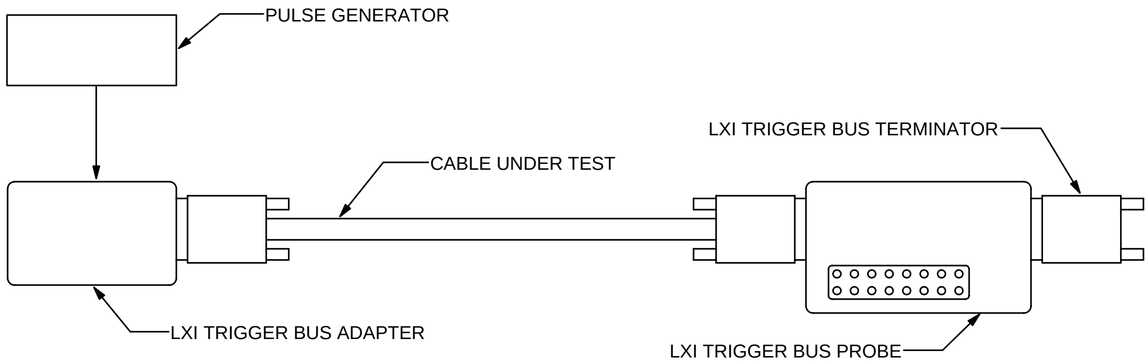

Figure 3.2

The pulse generator is set to provide a 10 KHz square wave output with an amplitude appropriate to drive the LXI Trigger Bus Adapter (see the user's manuals for details). The LXI Trigger Bus Adapter is configured for driven mode output on all channels, and the pulse generator is connected to drive channel LXI0. The other Channels are set to a fixed low state. The oscilloscope is setup with one channel set to 200mV/division, 50 ohms, DC coupled input and is connected to the positive half of the driven channel (beginning with LXI0p). The second channel of the oscilloscope is set to 20mV/division, 1Mohm, AC coupled input. The second channel input is used to check the un-driven cable connections for cross-talk. The oscilloscope's horizontal time-base is set for 200nS/division and the oscilloscope's acquisition mode is set to average 32 readings. Note that without averaging multiple readings, the cross-talk signal will be largely buried in noise.

3.2.3.2 Wired Pairing Test Procedure

The test for mis-wired pairs is preformed using a process of elimination technique. The pulse generator is first connected to drive LXI0 via the LXI Trigger Bus Adapter. The first channel of the oscilloscope is connected to the positive output of the LXI Trigger Bus Probe, and the second channel is connected to both the positive and negative outputs of LXI1 through LXI7, one output at a time. See Figures 3.3 through 3.6 for examples of typical oscilloscope displays for 0.5meters and 20meters in length showing both passing and failing conditions. Each output is checked for a cross-talk condition, and if any output displays this characteristic, the cable assembly shall fail this test.

Once channel LXI0 has been tested, the pulse generator output is moved to drive LXI1, and the positive and negative outputs of the LXI Trigger Bus Probe for channels LXI2 through LXI7 are checked for cross-talk. LXI0 does not need to be checked, as it has already been confirmed to not have a cross-talk condition. This process is repeated until all LXI Trigger Bus channels have been confirmed.

A cable assembly which has passed this test along with the basic continuity test shall be confirmed compliant.

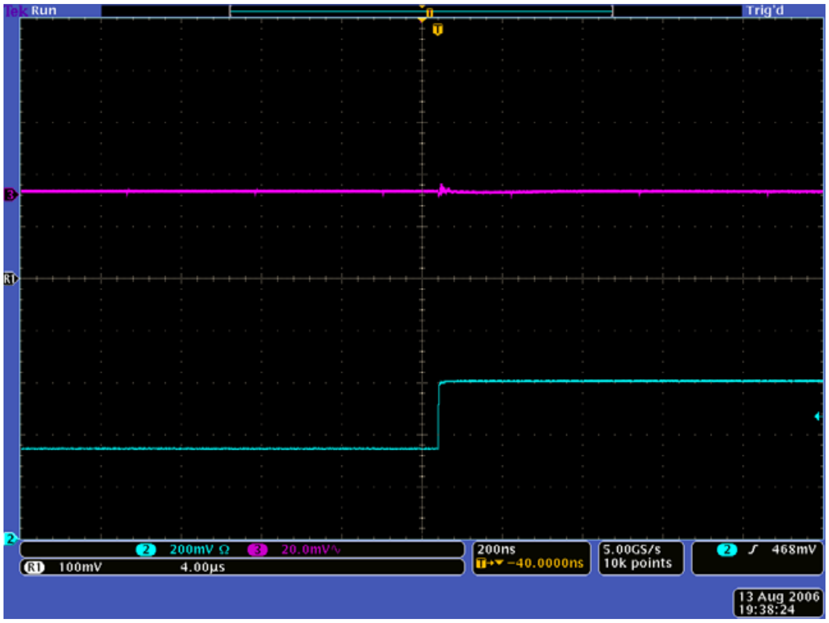

Figure 3.3 – 0.5 meter cable displaying no cross-talk

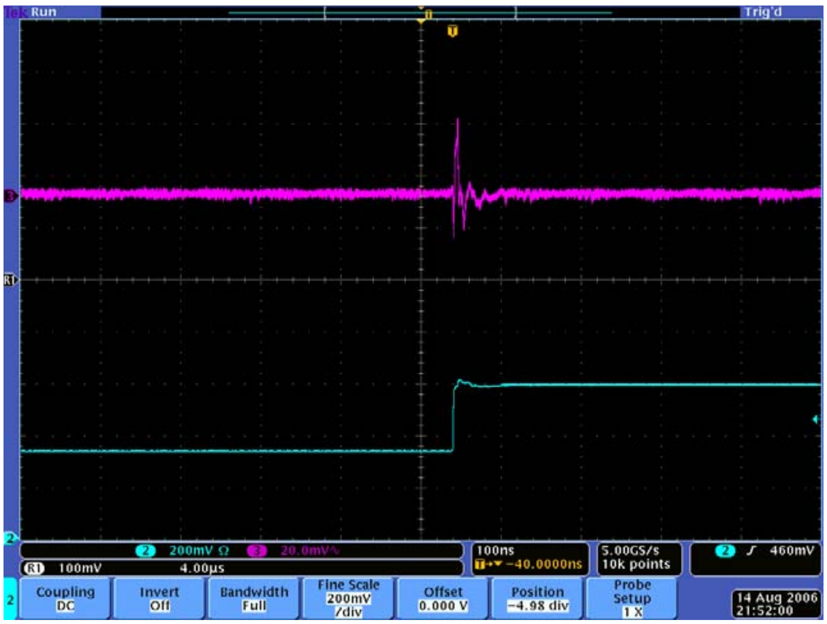

Figure 3.4 – 0.5 meter cable displaying cross-talk

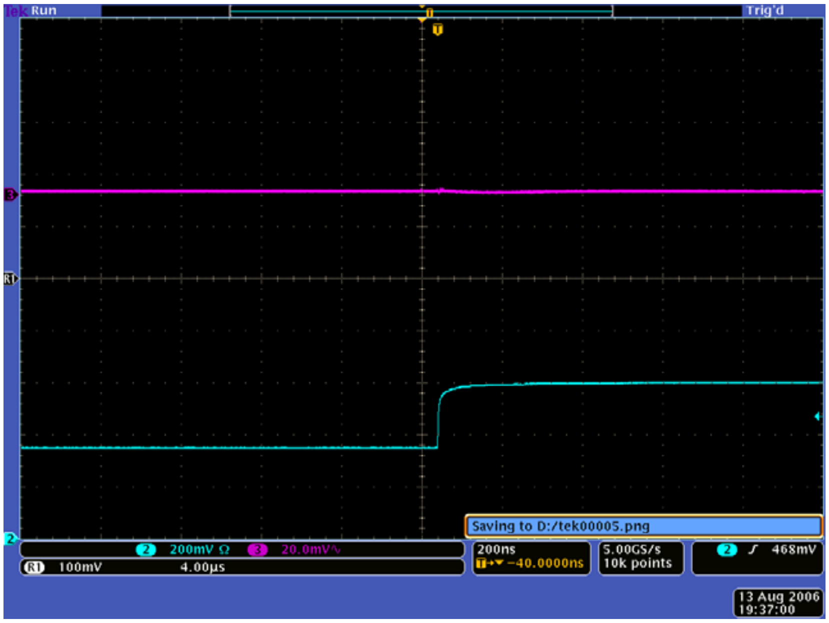

Figure 3.5 – 20 meter cable displaying no cross-talk

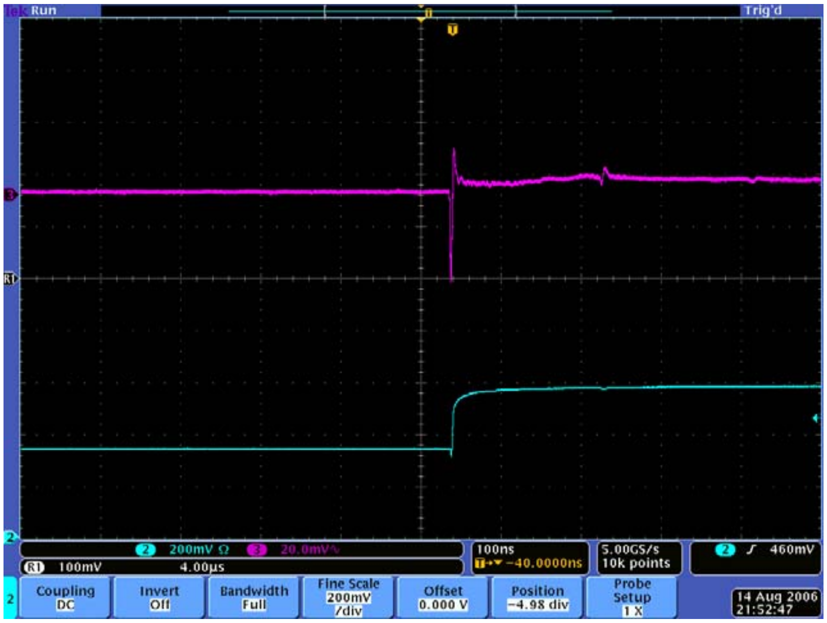

Figure 3.6 – 20 meter displaying cross-talk.

4 LXI TRIGGER BUS TERMINATORS

4.1 LXI Trigger Bus Terminator Mechanical Requirements

An LXI Trigger Bus Terminator consists of either a 25 pin Micro-D style plug connector which mates to an LXI Device, or a module with a 25 pin Micro-D style jack which mates to an LXI Trigger Bus Cable Assembly. Either device is wired to a printed circuit board which supports the required termination components, and may include additional components such as bus monitoring circuitry.

4.1.1 Rule – LXI Trigger Bus Terminator Physical Size

The completed LXI Terminator shall comply with all the requirements (both electrical and mechanical) of a 25 pin Micro-D style plug. An LXI Terminator implemented using a plug connector shall be no larger than a standard connector back shell.

4.1.2 Rule – EMI Shielding

The terminator shall be shielded to protect from EMI radiation and the shield must be terminated to the metal shell of the connector. The terminator device must provide standard jack screws to secure it to its mating connector and guarantee connectivity. See figure 4.1 for a typical implementation.

4.1.3 Rule – Labeling

The terminator shall be externally labeled to indicate that the device is an LXI Trigger Bus Terminator, and to which revision of this specification it complies.

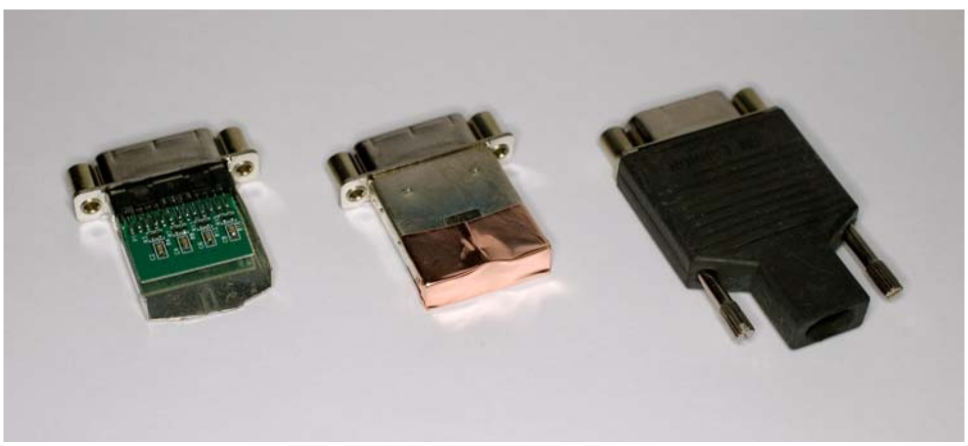

Figure 4.1

4.2 LXI Trigger Bus Terminator Electrical Requirements

Each end of an LXI Trigger Bus segment shall be terminated using an LXI Trigger Bus Terminator Block (except for devices which have a single trigger bus port and provide the termination function internally).

The Terminator Block provides a nominal 100 ohm differential termination to each of the eight LXI Trigger Bus channels and an AC common mode termination. This is accomplished by wiring two 50 ohm resistors in series and connecting a 0.01uF ceramic capacitor from the center tap of the resistors to ground. See Figure 4.2 for a schematic representation of the LXI Trigger Bus Terminator Block. Refer to the current LXI Specification Section 5.6 for component tolerances.

4.2.1 Rule – Termination Lengths

The connection lengths to the termination resistors and capacitors shall be kept to a minimum to assure a high quality termination. If the connection from the terminator's connector to the terminating resistors is greater than 5mm, the connections must be designed to provide a 100 ohm differential impedance up to the termination network.

4.2.1.1 Example – Terminator Layout

Figure 4.3 shows a typical board layout for an LXI Trigger Bus Terminator. The Printed Circuit Board is 0.700" by 0.500" in size, has two layers, and is constructed of 0.031" thick FR-4 type epoxy-glass material. The termination resistors are 0402 size thick film surface mount type, and the capacitors are 0603 size X7R dielectric surface mount type. The top layer is represented in red, and the bottom layer is represented in green.

4.3 LXI Trigger Bus Terminator Test Requirements

The LXI Trigger Bus Terminator shall be tested to provide a proper termination when installed in an LXI system.

4.3.1 LXI Trigger Bus Terminator Test Method

Using a precision ohm meter (such as the Keithley 2000 or equivalent), the resistance between each channel's positive and negative connection is measured using the four wire resistance measuring technique. Verify that each channel measures 100 ohms +/- 5%.

Using an LCR bridge (such as the Agilent 4263B or equivalent) set to measure capacitance and series resistance and operating at 10KHz, measure from each channel's positive and negative connection to ground. Verify that each channel connection measures 0.01uF +/- 20% with 50 ohm +/- 5% series resistance. Verify that the series resistances measured for the positive and negative connection of each channel are within 2% of each other.

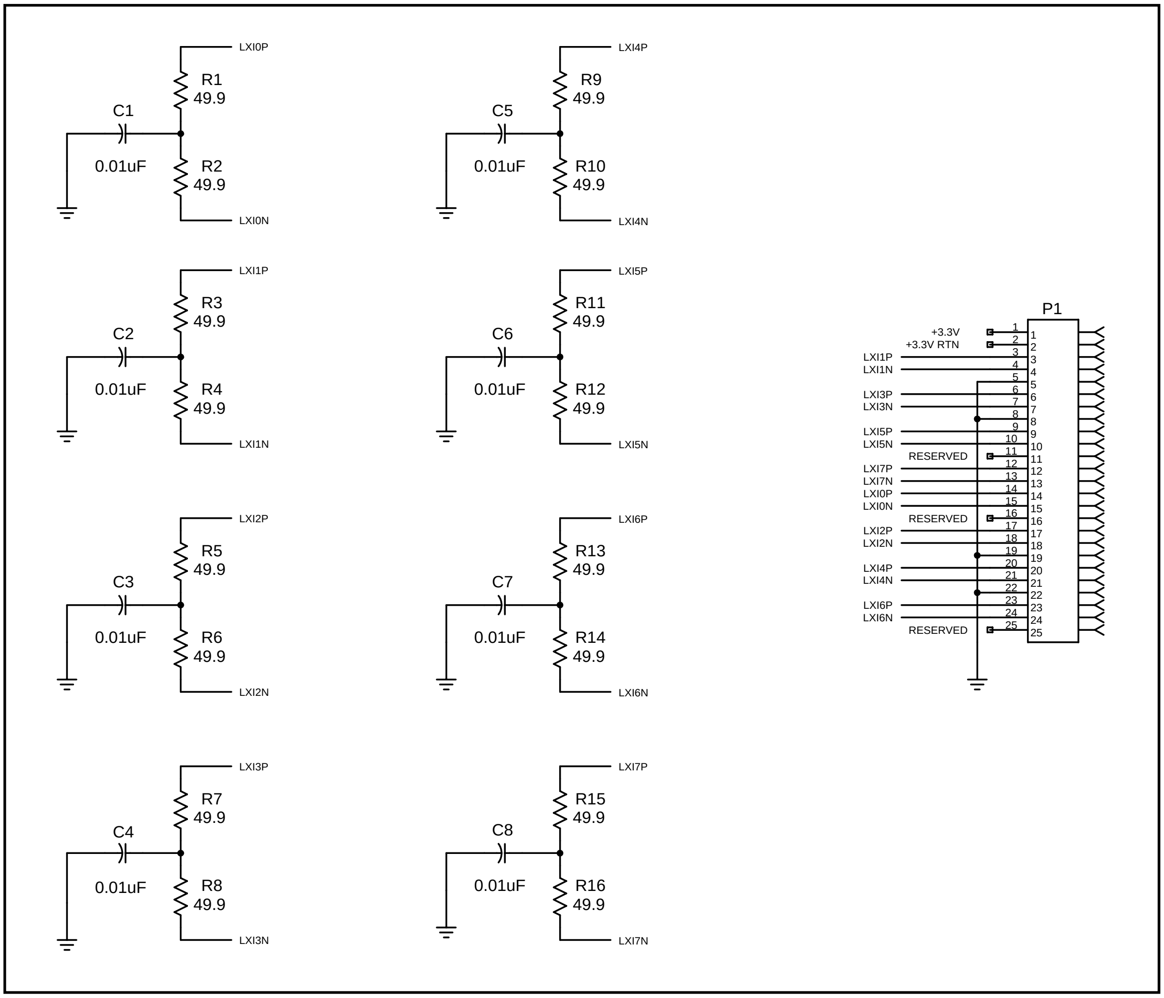

Figure 4.2

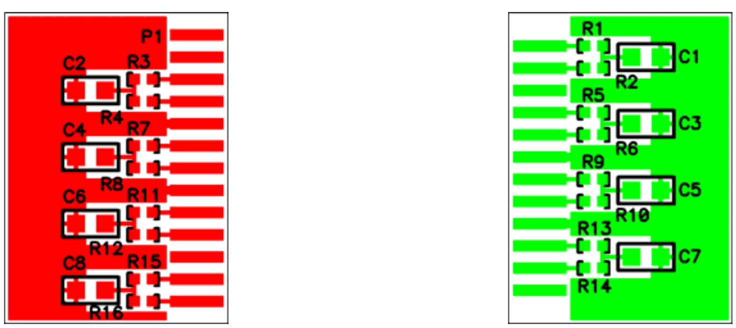

Figure 4.3

Appendix A Glossary of Terms

AWG

American Wire Gage. Measure of wire diameter.

AWM

Appliance Wiring Material. A UL designation for a type of wire.

CSA

Canadian Standards Association.

LVDS

Low-Voltage Differential Signaling.

LXI

Lan Extension for Instrumentation.

LXI Device

An instrument or other device which conforms to the LXI standard.

Micro D Connector

Connector style the commercial version of which is specified to be used on the WTB in the LXI Standard. This connector is compatible with the high reliability version of the Micro-D connector commonly used in military applications.

M-LVDS

Multipoint Low-Voltage Differential Signaling conforming to TIA/EIA-899 standard.

UL

Underwriters Laboratory.

TDR

Time Domain Reflectometer. A method of measuring impedance and defects in a transmission by propagating a pulse down the line and observing the reflections as a function of time (distance down the line).

Terminator

Device specified in the LXI Standard that terminates the differential pair transmission line used on the WTB.

WTB

Wired Trigger Bus.

Aeroflex
Agilent Technologies
Keithley Instrument, Inc.
Measurement Computing
Pickering Interfaces, Ltf.
EADS NA Defense
Rohde & Schwarz
VXI Technology, Inc.

Bruel & Kjaer S & M
Tektronix, Inc.

ADLINK Technology
Anritsu Company
Analogic Sky
BAE Systems
C & H Technologies
COM DEM Ltd.
Complete Networks, Inc
Corelis, Inc
Elgar Electronics
Fluke Corporation
Geotest
Goepel Electronic Gmbh
Lambda America
Pacific Mindworks
Pacific Power Source
Phase Matrix
Teradyne
The MathWorks, Inc.
Symmetricom
Unicversal Switching Corp
Venture Design Services
Ztec Instruments

Acquiris
Advantech Corporation
AMREL
Altera Corp
Beijing Institute of Radio Metrology and Measurement
California Instruments
Data Patterns (India) PVT., Ltd.
Data Translation
JDS Uniphase
Jitech Group Int'l Ltd
Kepco, Inc.
Pacific Mindworks
SofTec Microsystems
Symtx, Inc.
Zantrex Technology
Yokogawa Electric Corp